

REMARKS

Claims 1 – 39 are presently pending. In the above-identified Office Action, the Examiner rejected Claims 1, 2, 14 – 21 and 39 under 35 U.S.C. § 102(b) as being anticipated by Toyohara ('444). Claims 1 – 3, 7 – 9, 14, 15, 18, 19, 22, 26 – 28, 31, 32, 35, 36, and 39 were rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Patent ('417). Claims 4 – 6, 10, 12, 23 – 25, 29 and 30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent ('417) in view of Van Deventer ('016) or Koyano *et al.* ('081). Claims 10 – 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent ('417) in view of Skolnick *et al.* ('309) or Zhang *et al.* ('861). Claims 16, 17, 20, 21, 33, 34, 37 and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent ('417) in view of Isshiki ('306).

By this Amendment, Claim 1 has been amended to include the limitations of Claims 10 – 13. Claim 22 has been amended to include the limitations of Claims 29 and 30. Claim 39 has been amended to include the limitations of Claims 29 and 30 in method form. Claims 10 – 13, 29 and 30 have been canceled.

New Claims 40 – 45 have been added. Claims 40 – 42 depend from Claims 1, 22 and 39, respectively, and recite means for effecting real time control of signals output from certain ports of the inventive non-reciprocal optical element. Claim 43 tracks prior Claims 1, 4 and 5 in independent form. Claim 44 tracks prior Claims 1, 23 and 24 in independent form. Claim 45 is an independent claim drafted along the lines of Claim 1, as originally filed, with an additional limitation directed to means for effecting independent control of signals output by second and fourth ports in real time.

For the reasons set forth more fully below, the present application properly presents claims patentable over the prior art. Reconsideration, allowance and passage to issue are therefore respectfully requested.

The present invention addresses the need in the art for a system and method for providing independent control of beams propagating in opposite directions in nonreciprocal optical elements.

In accordance with the invention, the need is addressed with an NOE having a circulator, first and second reflective means at the second and fourth ports of the circulator, and first and second control means for adjusting the phase of signals output from the second and fourth ports respectively. The invention is set forth in claims of varying scope, of which Claim 1 as amended is illustrative. Claim 1 now recites:

1. A nonreciprocal optical element comprising:
 circulator means for routing a first signal from a first port to a second port and a second signal from the second port to a third port, a third signal from the third port to a fourth port and a fourth signal from the fourth port to the first port;
 first reflective means for reflecting a signal output by the second port back into the second port;
 second reflective means for reflecting a signal output by the fourth port back into the fourth port;
first control means for adjusting the phase of the signal output from the second port by adjusting the position of the first reflective means relative to the second port; and
second control means, independent of said first control means for adjusting the phase of the signal output from the fourth port by adjusting the position of the second reflective means relative to the fourth port. (Emphasis added.)

None of the references, including those cited but not applied, taken alone or in combination, teaches, discloses or suggests the invention as presently claimed. Specifically, none of the references teaches, discloses or suggests a non-reciprocal optical element having a circulator, first and second reflective means at the second and fourth ports of the circulator, and first and second control means for adjusting the phase of signals output from the second and fourth ports respectively by adjusting the position of reflective means relative thereto.

Inasmuch as Claim 1 includes the limitations of Claims 10 – 13 and Claims 22 and 39 include the limitations of Claims 29 and 30, a review of the Examiner's positions with respect to Claims 10, 12, 22 and 39 is in order.

With respect to rejections of Claims 10 – 13, the Examiner relied on the Japanese patent ('417), Skolnick *et al.* ('309) and Zhang *et al.* ('861). The Examiner acknowledged that the Japanese patent does not disclose means for adjusting the position

of the reflective means and suggested that this teaching is provided by Skolnick and Zhang *et al.*

However, there are several problems with this position. First, note that prior Claims 10 and 12 and current Claims 1, 22 and 39 are limited to means for adjusting the phase of the signals output by the second and fourth ports and are not simply limited to means for adjusting the position of the reflective means. This is significant inasmuch as, in accordance with the present teachings, a phase adjustment is effected by a **translation** of the reflective means.

However, Skolnick and Zhang address a change in **orientation** of a mirror to redirect a beam. These references clearly do not teach a change in phase of the beam.

Moreover, there is no basis for adding a phase adjustment capability to the systems of either the Japanese patent or Toyohara inasmuch as these references purport to teach optical repeaters and amplifiers respectively. As is well-known in the art, a phase change of an output signal relative to an input signal would be undesirable in an optical repeater or amplifier. Hence, there is no basis for adding a phase change teaching to the teachings of the primary references.

Van Deventer and Koyano were cited in combination with the Japanese patent in the rejection of Claims 10, 12, 29 and 30, *inter alia*. However, Van Deventer and Koyano were cited for teaching polarization rotators. These devices clearly do not effect a phase change **by adjusting the position of reflective elements** as presently claimed.

As to Claims 40 – 42, Applicants note that the prior art fails to teach, disclose or suggest a nonreciprocal optical element (NOE) with means for effecting control of signals propagating therethrough in real time. Hence, these claims should be allowable.

As to new Claims 43 and 44, it should be noted that neither Van Deventer, Koyano nor the Japanese Patent are nonreciprocal optical elements. As such, the combination would still fail to teach or suggest an NOE that preserves polarization for either direction of propagation. Hence, Claims 43 and 44 should be allowable.

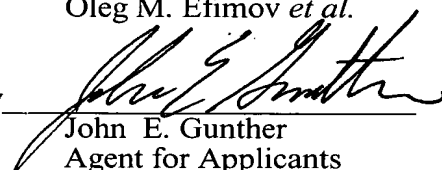
Claim 45 is an independent claim drafted along the lines of Claim 1, as originally filed, with an additional limitation directed to means for effecting independent control of signals output by second and fourth ports in real time.

As none of the references, including the references cited but not applied, taken alone or in combination, teaches, discloses or suggests the invention of Claim 45. That is, none of the references teaches, discloses or suggests an NOE having means for effecting independent control of signals output by second and fourth ports of a circulator thereof in real time.

Thus, Claims 1 - 9, 14 - 28 and 31 - 45 should be allowable. Reconsideration, allowance and passage to issue are respectfully requested.

Respectfully submitted,
Oleg M. Efimov *et al.*

By


John E. Gunther
Agent for Applicants
Registration No. 43,649

WJB/lc

Raytheon Company
Corporate Patents and Licensing
EO/E4/N119
P.O. Box 902
El Segundo, CA 90245

(310) 647-3723
(310) 647-2616 facsimile